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REMARKS

The application has been reviewed in light of the Office Action dated May 31, 2007. Claims 1-12 were pending. By this Amendment, claims 2-10 have been canceled, without prejudice or disclaimer, claims 1, 11 and 12 have been amended to clarify the claimed subject matter, and new claim 13 has been added. Support for the claim amendments can be found in the application as originally filed, for example, at page 9, lines 9-21, page 12, lines 3-14, and page 13, lines 2-14. Accordingly, independent claims 1 and 11-13 are the claims now pending.

Claims 1-4, 11 and 12 were rejected under 35 U.S.C. § 102(b) as purportedly anticipated by Fukui (JP 2003-309302). Claim 5 was rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Fukui in view of Takase (JP 2001-151566). Claim 6 was rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Fukui in view of Horino (JP 2002-265262). Claims 7 and 8 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Fukui in view of Kimura (JP 10-297969). Claims 9 and 10 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Fukui in view of Nishida (JP 2000-154054).

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1, 11 and 12 are patentable over the cited art, for at least the following reasons.

The present application relates to a liquid drop discharge head of a particular structure. The liquid drop discharge head comprises a nozzle configured to discharge a liquid drop by using a stacked layer type piezoelectric element. The stacked layer type piezoelectric element, unlike a normal piezoelectric film, has a structure where a piezoelectric layer and an inside electrode layer are reciprocally stacked. The stacked layer type piezoelectric element is

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advantageously used as a liquid drop jet head, for example, in a case where electric connection of minute patterns are desired.

In one aspect of the present application, in order to prevent an increase in cost due to a problem of heat resistance of the inside electrode, a piezoelectric material having a low sintering temperature equal to or less than 1200°C is used in the piezoelectric layer (independent claims 1, 11 and 12).

In another aspect of the present application, an anisotropic conductive film is not used for electric connection of the stacked layer type piezoelectric element, and a piezoelectric material having a Curie temperature higher than the Curie temperature of PZT is used (independent claim 1) so that low cost soldering can be performed.

In each instance, the piezoelectric material does not include lead, and therefore the risk of environmental pollution and dismantling cost can be made low.

Fukui (JP 2003-309302), as understood by applicant, proposes a piezoelectric film type element structure which is formed by non-lead material. Fukui identifies a list of no-lead materials.

However, the piezoelectric layer type element in the structure proposed by Fukui is not sintered with an electrode and others. Sintering with the electrode and electrode connection by soldering are simply not discussed nor suggested in Fukui.

Moreover, Fukui does not teach or suggest a nozzle configured to discharge a liquid drop by using a stacked layer type piezoelectric element wherein a piezoelectric layer and an inside electrode layer are reciprocally stacked (independent claims 1 and 11-13 of the present application).

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Further, Fukui does not teach or suggest that the piezoelectric layer is formed by a piezoelectric material having a sintering temperature equal to or less than 1200 °C (independent claims 1, 11 and 12 of the present application).

Likewise, Fukui does not teach or suggest that the piezoelectric layer is formed by a piezoelectric material having a Curie temperature higher than a Curie temperature of PZT (independent claim 13 of the present application).

In addition, Fukui does not teach or suggest a liquid drop discharge head having a structure wherein an FPC for supplying a driving signal to the piezoelectric element is directly connected to an end surface electrode of the stacked layer type piezoelectric element by solder (independent claim 13 of the present application).

The other cited references do not cure the deficiencies of Fukui.

Takase (JP 2001-151566), as understood by applicant, proposes a lead-free piezoelectric ceramic made of bismuth sodium titanate, barium titanate and bismuth potassium titanate.

Horino (JP 2002-265262), as understood by applicant, proposes a piezoelectric ceramic of a specified lead-free composition.

Kimura (JP 10-297969), as understood by applicant, proposes a piezoelectric ceramic composition that is free from lead.

Nishida (JP 2000-154054), as understood by applicant, proposes a piezoelectric element of a piezoelectric porcelain composition.

However, applicant does not find teaching in the cited art of a liquid drop discharge device comprising a liquid drop discharge head configured to discharge a liquid drop, wherein the liquid drop discharge head includes a nozzle configured to discharge the liquid drop by using

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a stacked layer type piezoelectric element formed by reciprocally stacking a piezoelectric layer and an inside electrode layer, and the piezoelectric layer is formed by a piezoelectric material not including lead but having bismuth sodium titanate as main ingredients, the piezoelectric material having a sintering temperature equal to or less than 1200 °C, as provided by the subject matter of claim 1 of the present application. Independent claims 11 and 12 are patentably distinct from the cited art for at least similar reasons.

In addition, applicant does not find teaching in the cited art of a liquid drop discharge head comprising a nozzle configured to discharge a liquid drop by using a piezoelectric element, wherein the piezoelectric element is stacked layer type piezoelectric element formed by reciprocally stacking a piezoelectric layer and an inside electrode layer, the piezoelectric layer is formed by a piezoelectric material not including lead but having potassium niobate as main ingredients, the piezoelectric material having a Curie temperature higher than a Curie temperature of PZT, and an FPC for supplying a driving signal to the piezoelectric element is directly connected to an end surface electrode of the stacked layer type piezoelectric element by solder, as provided by the subject matter of claim 13 of the present application.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.


If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

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If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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